

Effect of irrigation and NPK on nutrient uptake pattern and qualitative parameter in winter maize+ potato intercropping system

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ABSTRACT

A field experiment was conducted at Pusa (Bihar) in winter season 2000–2001 and 2001-2002 to find out the influence of levels of irrigation and NPK on nutrient uptake and quality parameter of winter maize + potato intercropping system. There was significant effect of irrigation and NPK levels on nutrient uptake as well as quality parameters. The rate of increasing nutrient uptake was higher with 1.25 IW/CPE ratio but was at par with 1.00 IW/ CPE ratio in maize and potato during both years of experimentation but protein content was found highest at 0.5 IW/CPE and decreased gradually with increased frequency of irrigation in both the crops. Protein content was found higher with increased level of fertilizer in maize as well as potato. Starch content in potato increased with an increasing level of irrigation and fertilizer.

Key words : Irrigation, Fertilizer, Maize + potato, Protein and Starch.

INTRODUCTION

Winter maize is gaining popularity due to its high production level in north Bihar as well as some part of Uttar Pradesh and the acreage of the crop is increasing rapidly, day by day. The growth of this crop is slow during first three months due to low temperature and the space between the two rows are left unutilized. Therefore, there is a scope of taking some intercrops in order to increase the production potential per unit area and time and thereby to decrease the cost of production as compare to sole crop alone. In winter there is scarcity of moisture in the soil and so, frequent irrigations should be given to the crops. As maize is heavy feeder of NPK but most of the applied nutrient left unused in the field. By taking potato as intercrop with maize these unused fertilizers may get consumed by the intercrop without any adverse effect on the sole crop. There is paucity of information in respect of scheduling irrigation and optimum fertilizer level to the maize crop as well as to the intercrop. So present experiment has been aimed to study the effect of irrigation and NPK on nutrient uptake pattern of maize + potato intercropping, system and its qualitative parameters.

MATERIALS AND METHODS

The field experiment was conducted during winter (rabi season) 2000-2001 and 2001-2002 at Research farm of Rajendra Agricultural University, Bihar, Pusa on sandy loam soil with organic carbon 0.41 per cent, available nitrogen 249.4 kg/ha, available phosphorus 18.5 kg/ha and available potassium 105.8 kg/ha and field capacity 22.5 per cent permanent wilting point 8.25 per cent and bulk density of 1.46 g/cc and alkaline in reaction (pH = 8.6). The experiment was laid out in split plot design (SPD) with four irrigation levels based on IW/CPE ratio ($I_1 = 0.5$ IW/CPE ratio, $I_2 = 0.75$ IW/ CPE ratio, $I_3 = 1.00$ IW/CPE ratio and $I_4 = 1.25$ IW/CPE ratio) and four NPK levels ($F_1 = 100\%$ recommended dose of NPK in maize + 25% recommended dose of NPK in potato, $F_2 =$ Full recommended dose of NPK

in maize + 50% recommended dose of NPK in potato, $F_3 =$ Full recommended dose of NPK in maize + 75% recommended dose of NPK in potato and $F_4 =$ Full recommended dose of NPK in maize + 100% recommended dose of NPK in potato) comprising of 16 treatments with four replication. The variety of maize and potato was "Laxmi" and "Rajendra Potato-1," respectively. Potato was sown at 10th and 8th Nov. in 2000-2001 and 2001-2002, respectively and maize was sown at 20th and 22nd November, 2000 – 2001 & 2001-02, respectively. Protein and starch content was estimated on dry weight basis. Other agronomic management and plant protection measures were followed uniformly.

RESULTS AND DISCUSSION

Maize

Different irrigation and fertilizer levels had influenced the nutrient uptake and other quality parameters in maize as well as in potato crop to a great extent. Higher NPK uptake (87.49, 36.57 and 84.12 kg/ha, respectively in 2000-2001 and 92.75, 38.31 and 84.12 kg/ha respectively in 2001-2002) was recorded at irrigation applied at 1.25 IW/ CPE and was found at par with 1.00 IW/CPE followed by 0.75 IW/CPE and 0.5 IW/CPE. While protein content was recorded higher at 0.5 IW/CPE (9.21 % in 2000-2001 and 9.34% in 2001-02) followed by 0.75 IW/CPE, 1.00 IW/CPE and 2.25 IW/CPE. This may happen due to the fact the leaching loss of nitrogen increased with an increasing irrigation levels. The result is inconformity with the result obtained by Prasad and Prasad (1988).

NPK uptake was recorded with increased level of fertilizer. Highest NPK uptake was recorded with full dose of NPK in maize + 100% NPK in potato (106.91, 40.97, 87.08 kg/ha, respectively) but was found at par with full dose of NPK in maize + 75% NPK of potato. Protein content (9.50%) in maize grain was also found highest with higher level of applied fertilizer and followed same trend as described above. This may be due to the fact that availability

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of available nitrogen was increased with increased levels of fertilizer nitrogen. Plants had got optimum amount of available nitrogen and translocated to the sink. Thus protein content in maize grain was found higher with increased levels of fertilizer and ultimately increased yield of maize grain (Table 1). The same trend was found by Reddy and Reddy (1981).

IW/CPE. Protein content was found highest when irrigation applied at 0.5 IW/CPE (10.08%) and decrease gradually with an increase in irrigation frequency. The reason behind this was same as in case of maize. While starch content in potato was found highest with 1.25 IW/CPE ratio and was at par with 1.00 IW/CPE ratio. The result was inconformity with the result obtain by Sharma and Dixit (1992).

Table 1: Effect of irrigation and NPK levels on nutrient uptake and qualitative characters of winter maize.

Treatments	Maize									
	N		P		K		Protein content (%)		Yield (q/ha)	
	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
<i>Irrigation</i>										
T ₁	74.67	77.58	18.90	20.06	52.62	53.15	9.21	9.34	35.57	39.84
T ₂	79.30	83.66	26.44	27.90	62.07	65.31	8.77	8.87	40.20	46.20
T ₃	85.46	89.58	33.68	35.36	71.09	76.94	8.60	8.68	43.87	50.92
T ₄	87.25	92.75	36.57	38.31	81.02	84.12	8.12	8.20	46.80	54.30
SEM±	1.43	2.03	0.95	1.08	2.35	2.41	0.20	0.20	1.17	1.27
CD at 5%	4.21	6.11	3.01	3.32	7.13	7.36	0.63	0.64	3.75	4.07
<i>Fertility level</i>										
F ₁	53.20	56.20	14.04	14.68	42.06	43.61	7.74	7.85	33.37	38.35
F ₂	76.18	79.05	28.90	27.08	61.33	64.73	8.49	8.57	40.42	46.47
F ₃	96.35	101.42	35.85	38.83	79.13	84.12	9.17	9.27	45.25	52.07
F ₄	100.75	106.91	39.69	40.97	84.03	87.08	9.50	9.40	47.40	54.42
SEm±	2.51	2.88	1.00	1.16	2.42	2.61	0.20	0.21	2.14	1.13
CD at 5%	7.60	8.72	3.02	3.51	7.75	8.35	0.63	0.67	6.14	3.24

Potato

Highest NPK uptake was recorded at 1.25 IW/CPE (78.82, 22.0 & 114.67 kg/ha, respectively in the year 2001-2002) and was found at par with irrigation applied at 1.00

Highest NPK uptake (88.31, 22.60, 44.84 kg/ha, respectively) was recorded with highest dose of applied NPK fertilizers i.e. full dose of NPK in maize + 100%, NPK in potato. The same trend was also observed in case of protein

Table 2 : Effect of irrigation and NPK levels on nutrient uptake and qualitative characters of Potato.

Treatments	Potato											
	Nutrient uptake by whole potato (kg/ha)						Protein content (%)		Starch content (%)		Tuber yield (q/ha)	
	N		P		K		2000-01	2001-02	2000-01	2001-02	2000-01	2001-02
<i>Irrigation</i>												
T ₁	58.34	62.16	12.28	12.73	54.71	58.65	10.06	10.08	10.17	10.18	134.50	153.73
T ₂	59.98	70.40	15.07	17.85	73.49	86.04	9.33	9.34	12.18	12.22	148.37	168.08
T ₃	62.30	77.00	17.07	20.83	87.68	103.66	9.02	9.05	13.01	13.05	160.25	182.68
T ₄	62.26	78.82	17.86	22.00	96.41	114.67	8.81	8.86	13.54	13.60	164.82	187.76
SEM±	1.47	2.04	0.37	0.67	3.02	3.70	0.27	0.27	0.22	0.24	2.88	4.32
CD at 5%	4.70	6.21	1.19	2.03	9.68	11.13	0.8	0.88	0.72	0.78	8.60	13.84
<i>Fertility level</i>												
F ₁	46.94	50.12	12.51	12.42	57.95	60.07	7.81	7.81	10.35	10.39	135.92	154.71
F ₂	56.45	66.94	14.53	17.45	72.03	83.01	9.06	9.08	12.06	12.11	147.10	167.52
F ₃	67.62	83.00	17.30	20.94	88.99	105.08	9.91	9.95	12.99	13.03	160.20	181.89
F ₄	71.86	88.31	17.94	22.60	93.31	114.84	10.43	10.46	13.50	13.52	164.72	188.13
SEm±	1.48	2.45	0.34	0.69	2.90	3.88	0.26	0.27	0.21	0.23	2.30	4.21
CD at 5%	4.26	7.37	0.99	2.11	8.33	11.67	0.74	0.76	0.61	0.66	6.61	12.08

content (10.46%) and starch content (13.52%) and was at par with 100% dose of NPK in maize + 75% dose of NPK in potato. The reason behind this due to the fact that potato is heavy feeder of plant nutrients and when it got more plant nutrients uptake by the crops which also increased the protein and starch content in tubers and ultimately tuber yield (188.13 q/ha) (Table 2). The same trend was found by Singh and Singh (1989). On the basis of the above findings it may be concluded that in maize + potato intercropping system irrigation should be scheduled at 1.00 IW/CPE with full dose of NPK in maize + 75% dose of NPK in potato for getting quality yield and maximum returns.

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